

COMMAND TRAINING PACKAGE

304X4-31F



AN/TSC-107
FAMILIARIZATION

MARCH 1983

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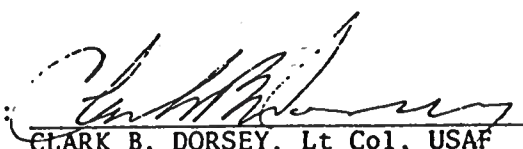
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PREFACE

This System Familiarization Package is designed to acquaint you with the equipment and capabilities of the AN/TSC-107 Quick Reaction Package (QRP). This package will be supplemented by a series of Qualification Training Packages (QTPs) that are currently under development. A list has been provided at the end of this package (Section VII), showing publication numbers and giving a summary of the contents of each QTP.

This package was authored by Mr. Darrell Carpenter, 5CMBTCG, Robins AFB, GA, produced by TSgt John G. Evans, and edited by TSgt Garry R. Gross, 1872 SCHS Training Development Branch, Keesler AFB, MS. If you have improvement recommendations, suggestions, error corrections, or positive/negative comments, please jot them down on the enclosed correction sheet (Atch 1) and send it to us. In return, we pledge to devote all of our resources to providing you with the best possible training materials.

AUTHORIZED BY:


CLARK B. DORSEY, Lt Col, USAF
Deputy Director of Maintenance Engineering
DCS/Logistics

SECTION I - SYSTEM INTRODUCTION

The AN/TSC-107 is designed to provide minimum essential communications with a quick reaction time -- hence the term, "Quick Reaction Package (QRP)". As you can see in figure 1, the QRP consists of three main units: an equipment shelter, a support vehicle, and a power trailer. All equipment and vehicles were specifically chosen to satisfy this quick-reaction/ease-of-maintenance concept.

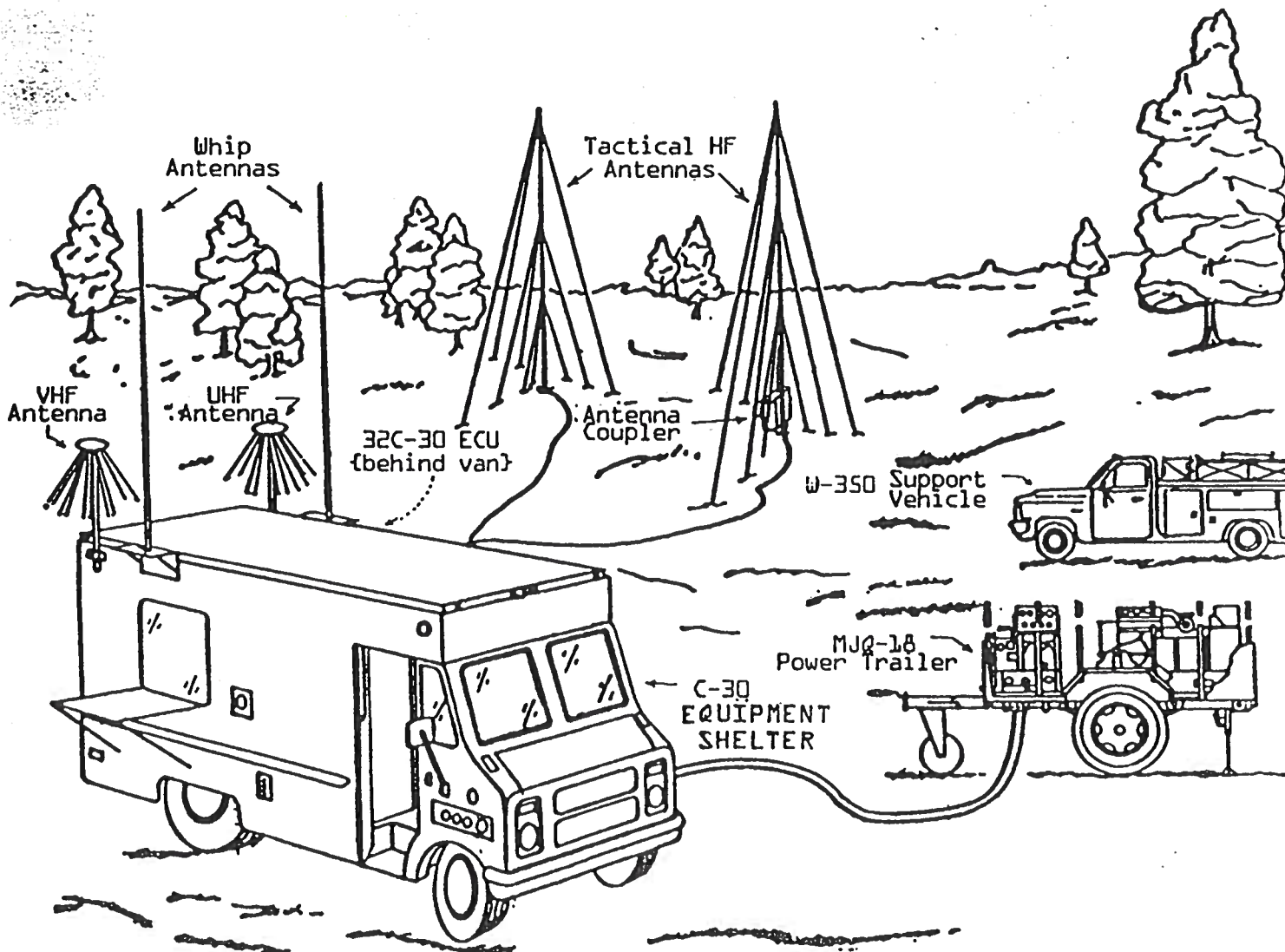


Figure 1, Typical QRP Deployment Scene

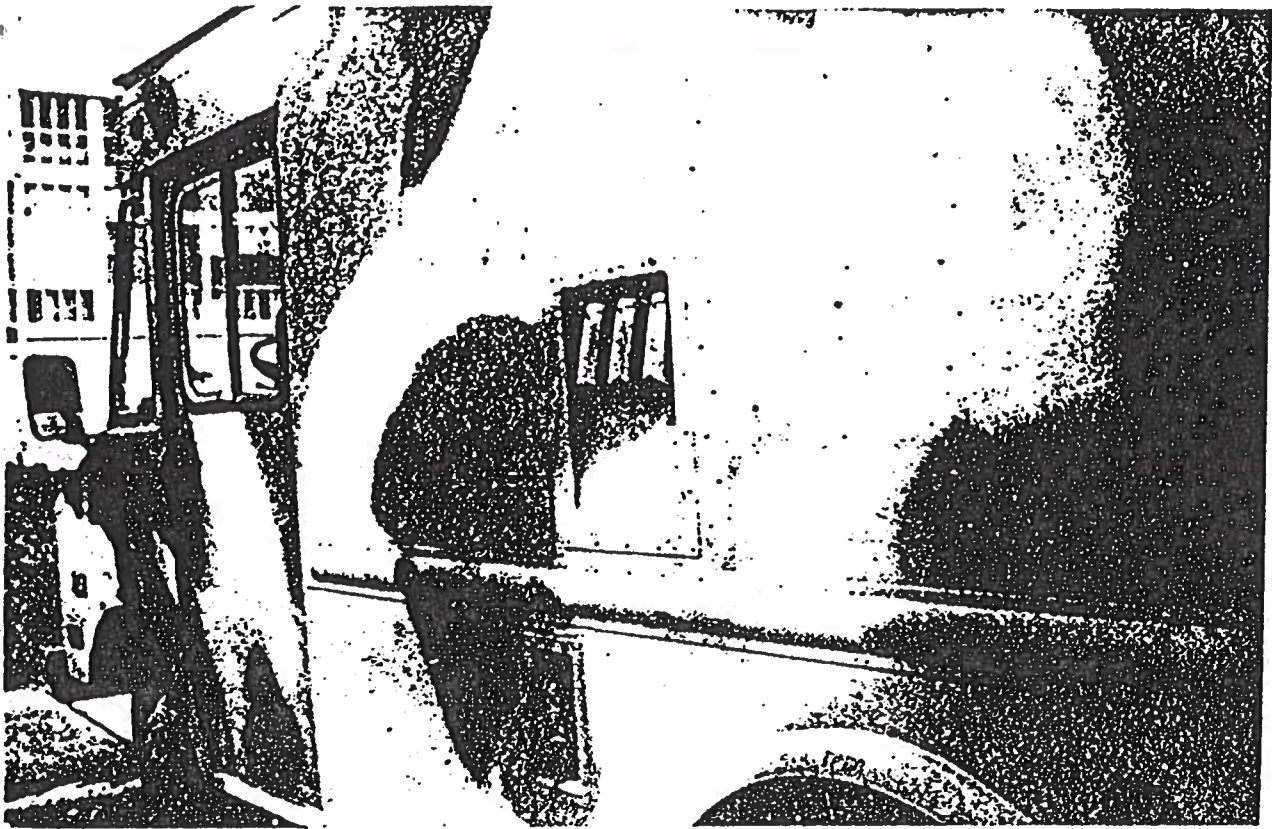


Figure 2a, QRP Van, Roadside View

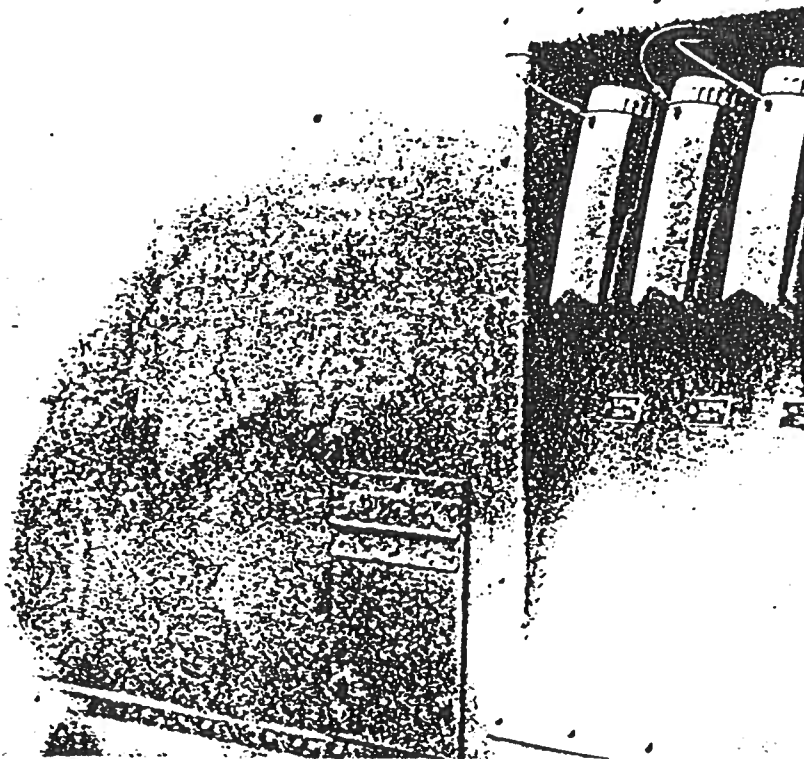


Figure 2b, Closeup of 407L Cable Hocks

~~SHELTER EXTERIOR.~~ As seen in figures 2 & 3, the equipment shelter is a Chevrolet C30 Step Van. This vehicle is also the prime mover over short distances. The roadside of the van has mounts for a UHF antenna, an HF whip antenna, and the GCU-1935 antenna coupler. This side also has external connections for power, ground, RF signals, and the 407L cable hocks.

A closeup of the cable hocks is seen in figure 2b. The primary transmission system for the QRP is the AN/TSC-94 GMF Satellite Earth Terminal. The right-hand cable hock provides the connection between the QRP van and the GMF Satellite Earth Terminal. Most communications systems in the van are equipped to provide a signal level of -10 dBm to a satellite terminal or 0 dBm to other systems.

The curbside view shown in figure 3 has RF connections for HF ISB #1, the weather receiver, UHF, VHF, and the HF transceiver. This side has brackets for mounting the VHF antenna and another HF whip. There is also a sliding window with one-way glass for the pick-up and delivery of messages.

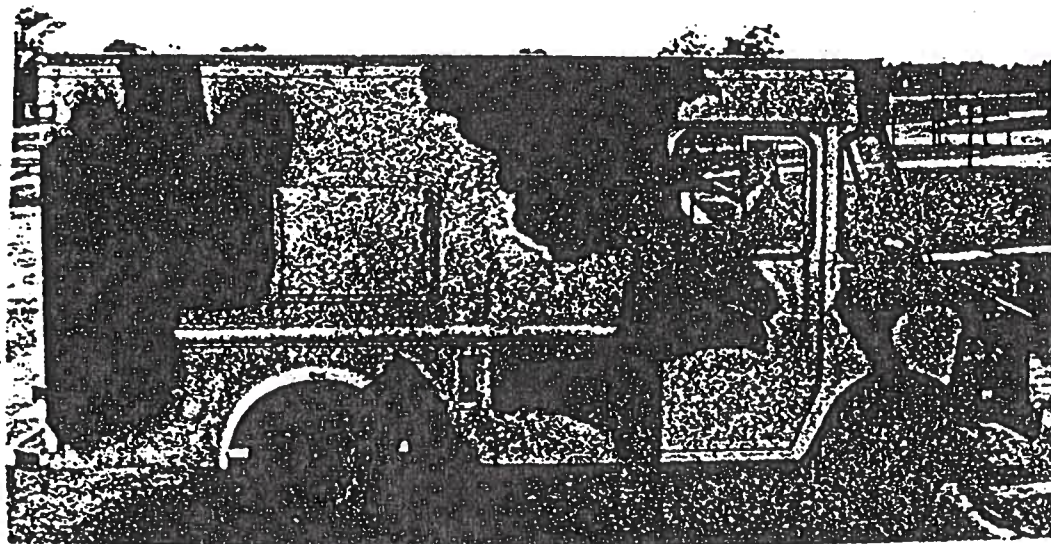


Figure 3, QRP Van Curbside View

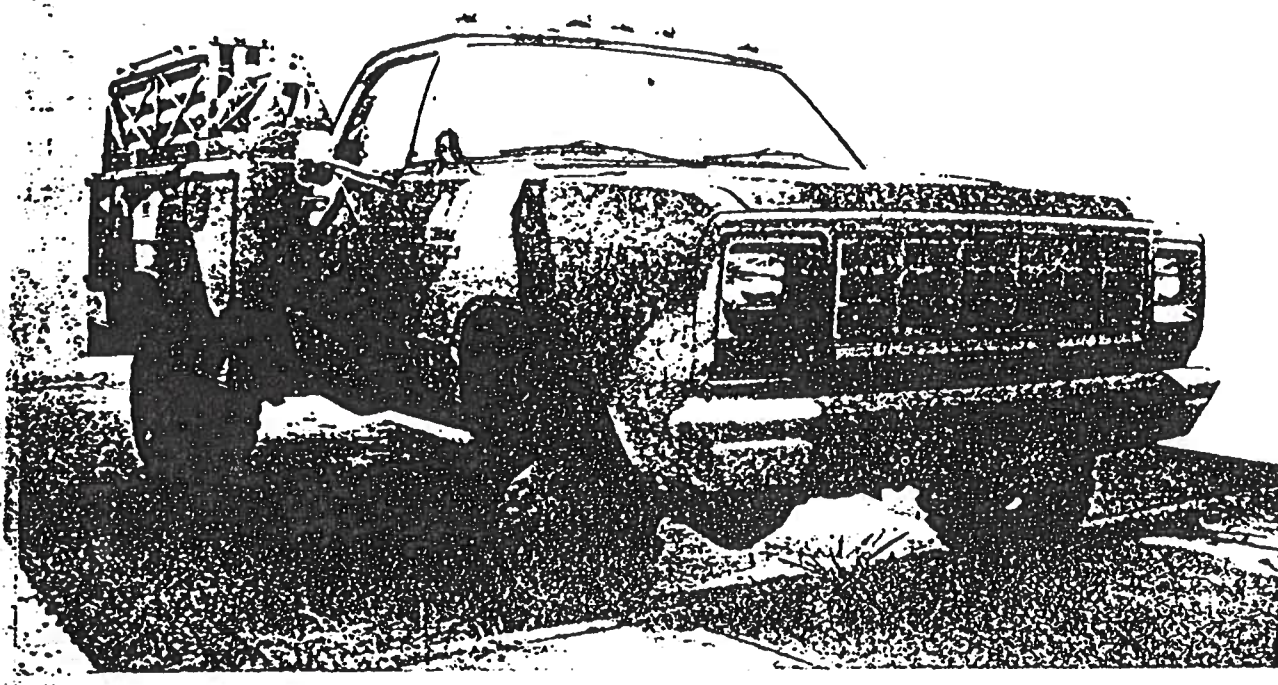


Figure 4a, W-350 Support Vehicle (front/right side)

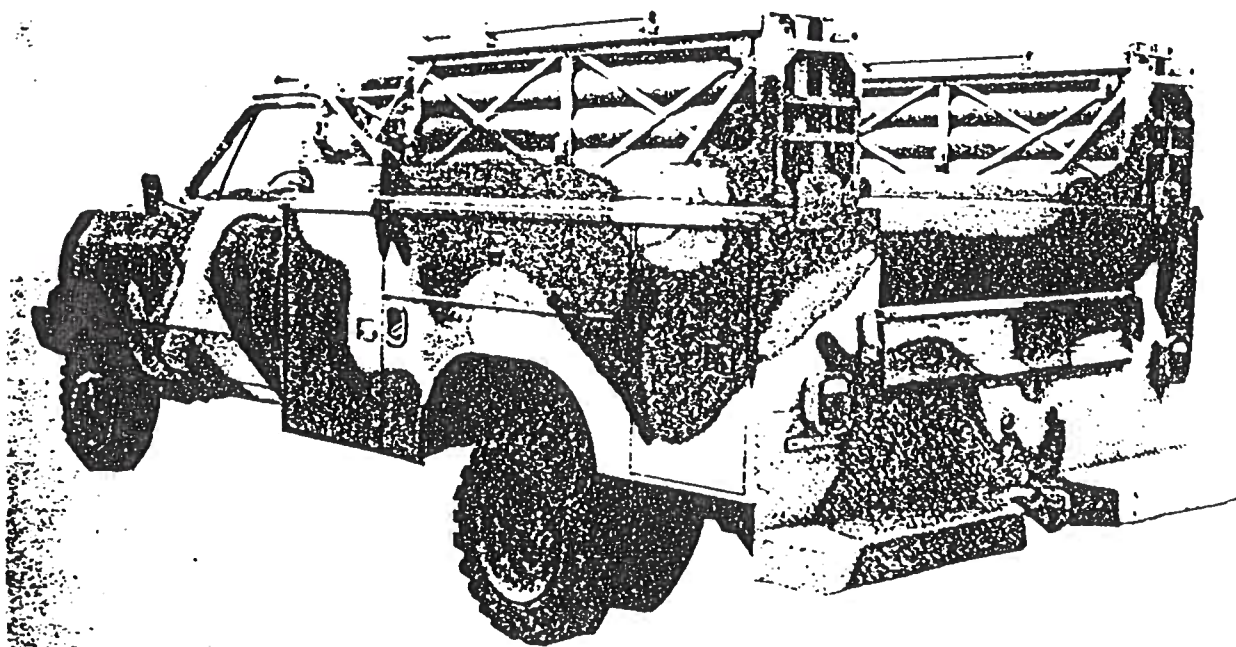


Figure 4b, W-350 Support Vehicle (rear/left side)

The Environmental Control Unit (ECU) input duct is connected to the left (roadside) section of the rear door, while the return duct is connected to the driver's door. The two ECUs provided are A/E 32C-30s. Only one unit is required at a time; the other is a backup unit. These ECUs provide for cooling only, and are transported in the support truck.

SHELTER INTERIOR. Inside the rear compartment, along the roadside wall, is a circuit breaker panel, AC voltmeter, frequency meter, C-551 lightning arrestors, and shelf space for data equipment. Along the curbside, the inner wall has additional shelf space. Blackout curtains are provided for all windows in the front compartment. The rest of the interior space is filled with the comm equipment we'll discuss in Sections II through V.

SUPPORT VEHICLE. The support vehicle is a W-350, 4-wheel drive, line truck (figures 4a and b). The equipment boxes mounted in the rear are used for transporting WRSK supplies. The AB-577 antenna structures are stored above these boxes.

POWER TRAILER. A modified M-103 trailer (refer back to figure 1) serves as the power trailer. It contains the two MEP-003A generators and a switch box. The system is designated an AN/MJQ-18 Power Generation System. The MEP-003A generators each provide 10-KW, 60-Hz, 120-V, single-phase power.

MANNING. QRP manning consist of 17 slots, distributed as follows.

291X0	6 ea
293X0	3 ea
304X4	3 ea
306X0	1 ea
307X0	3 ea
542X2	1 ea

This should be sufficient personnel to support 24-hour operations. In addition, when deployed in most overseas locations, an officer must accompany the package.

NOTE: When the present Crypto equipment is replaced with KG-84 equipment, plans are to drop the 306X0 slot and add a 304X4.

DEPLOYMENT. The limiting factors for deployment of a Quick Reaction Package are the size and weight requirements for redeployment in overseas areas. Usually, such redeployment will be accomplished by C-130 aircraft. The step van, support truck, power trailer, and required personnel can all be transported by a single C-130 aircraft.

MAINTENANCE. The maintenance concept for the QRP is to replace entire units and/or circuit cards while deployed. More in-depth maintenance will be performed in-garrison. The War Readiness Spares Kit (WRSK) contains most circuit cards and, in a few instances, complete components (e.g. MPC-1000T, STU-5, ARC-186, ARC-164). Test equipment is rack-mounted in the van.

SECTION II - RADIO SYSTEMS

HF ISB. When a GMF Satellite Earth Terminal is not used, the primary transmission system is the Sunair 1-kW HF/ISB system provided with the AN/TSC-107. This system consists of the following components:

GSR-920 Receiver (figure 5a)

GSE-924 Exciter (figure 5a)

GSL-1900A Linear Power Amplifier (figure 5b)

GCU-1935 Antenna Coupler (not shown)

The primary equipment shown in figures 5a and b, with the exception of the antenna coupler, is mounted in rack A4 behind the passenger seat. The system also has a spare receiver, exciter, and power amplifier for back-up. This back-up system is mounted behind the driver's seat in rack A6.

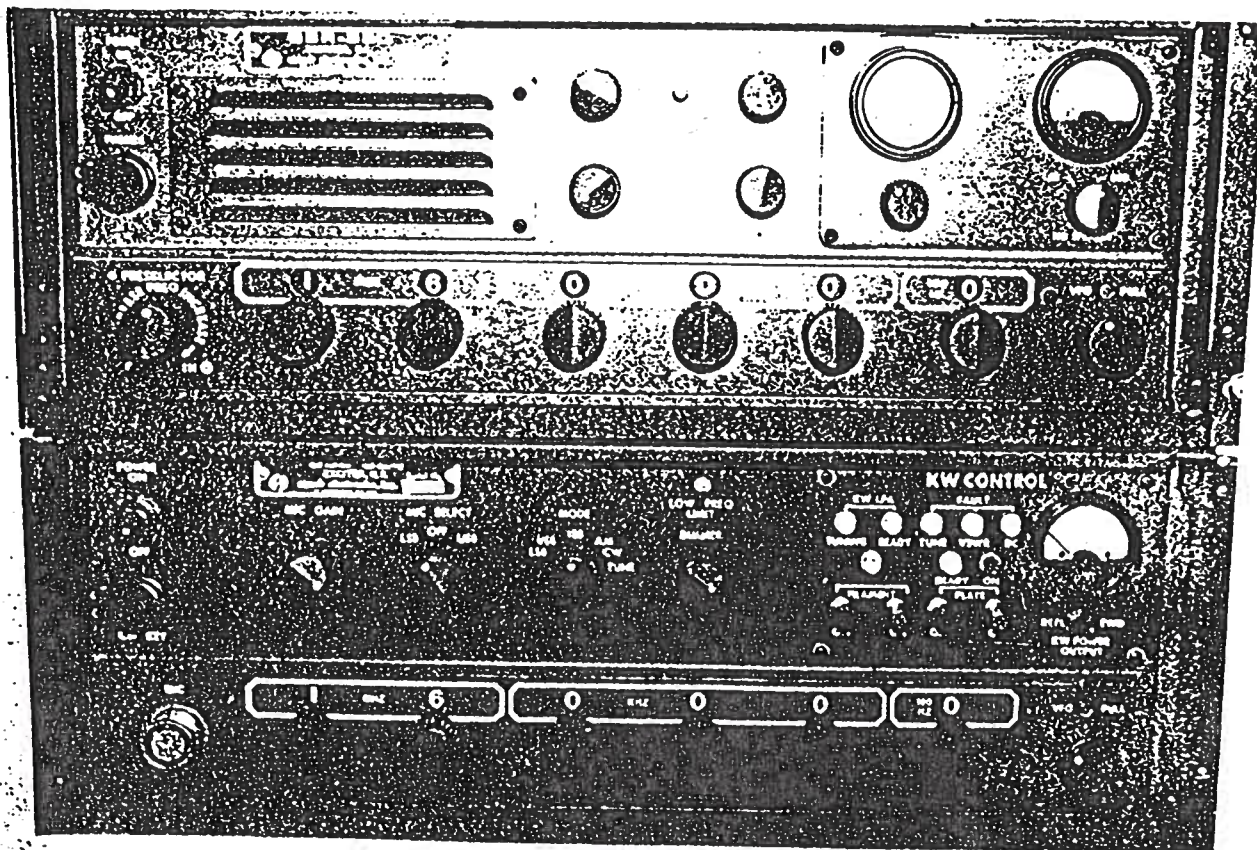


Figure 5a, GSR-920 Receiver (above)
GSE-924 Exciter (below)

Either system is capable of transmitting and receiving upper sideband, lower sideband, continuous wave, or amplitude modulated signals in the 1.6- to 30-MHz range. In the ISB mode (using upper and lower sidebands), this system is capable of transmitting one voice signal and a teletype tone pack of up to eight teletype signals (narrow shift).

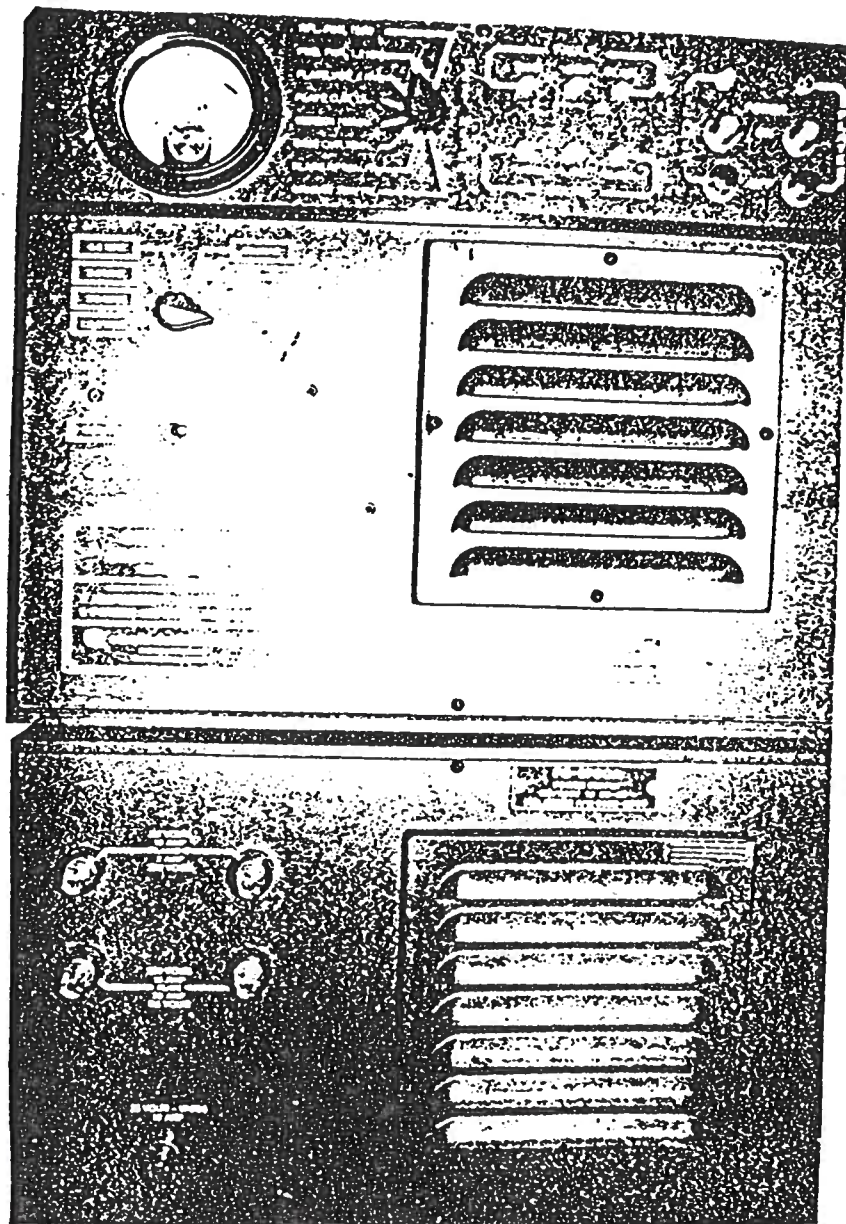


Figure 5b, GSL-1900 Linear Power Amplifier

HF SSB. One AN/URC-92, HF/SSB system, has also been included in the QRP (figure 6). The URC-92 is mounted on the engine cover, between the driver and passenger. This radio is capable of operating in the upper sideband, lower sideband, continuous wave, or amplitude modulation mode, with a frequency range of 1.6 to 30 MHz, and a nominal output of 100 watts. This system includes a GCU-935 coupler for use with non-resonant antennas. The URC-92 can be operated in the simplex, half-duplex, or duplex mode.

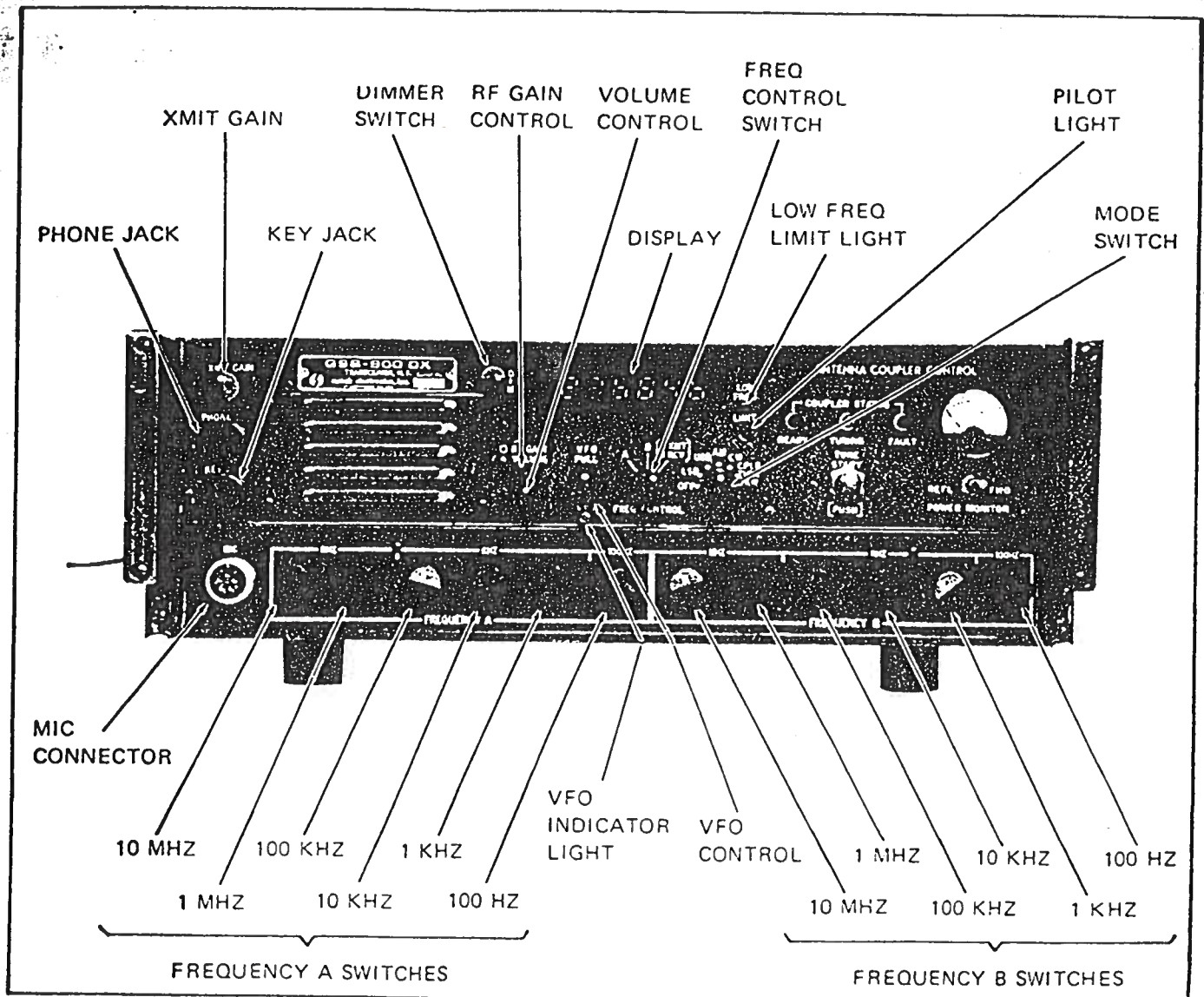


Figure 6, AN/URC-92 HF SSB System

VHF. VHF capability in both AM and FM bands is provided by the AN/ARC-186(V). This system, mounted in a CA-218R equipment rack (figure 7), is located in an overhead console in front of the passenger.

The AM band covers frequencies of 108 to 151.975 MHz. The lower portion of the AM band, from 108.0 to 115.975 MHz, is limited to receive operation only. Full transmit/receive operation is available from 116.0 to 151.975 MHz. The FM band covers frequencies of 30 to 87.975 MHz. Channel spacing is in 25-kHz increments for either band. Twenty channels may be preset. Output power is 10-watts minimum for AM and 16-watts maximum for FM. A DHV-80 omni-directional antenna is included. The ARC-186 may be removed from the QRP van and loaned to the customer who can provide 120-VAC, 60-Hz power.

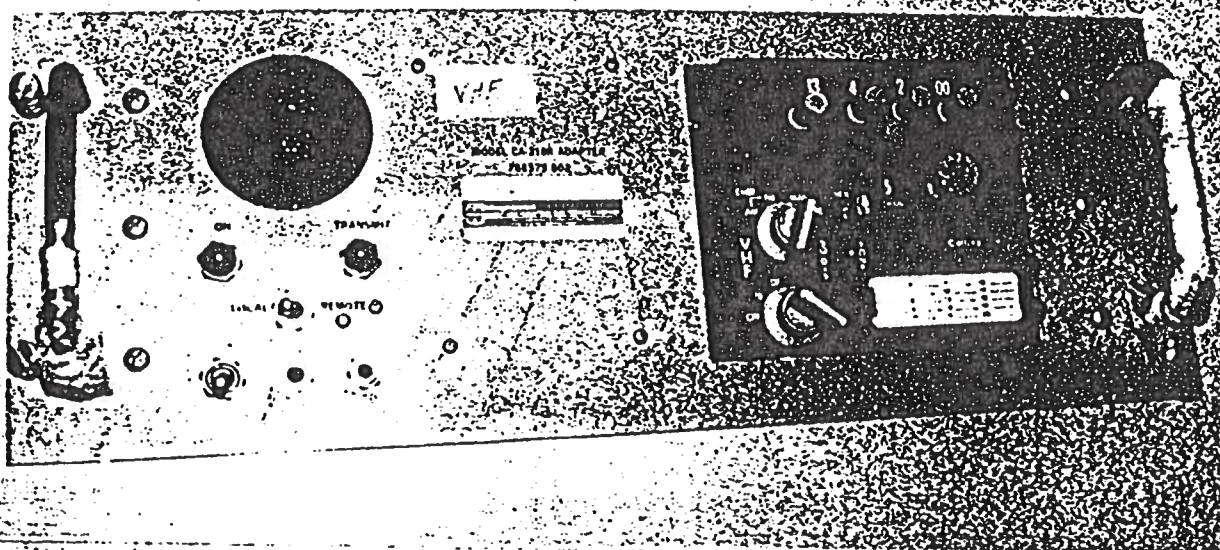


Figure 7, AN/ARC-186(V) VHF Radio System

UHF. The AN/ARC-164(V) radio set provides UHF capability. This set, including its CA-218R rack adaptor (figure 8), is located in an overhead console in front of the driver. The ARC-174 operates in the frequency range of 325 to 399.975 MHz. It provides 7,000 channels and an auxiliary Guard Receiver. Nominal output of the transmitter is 10 watts. A DHV-190 omnidirectional antenna is supplied. The ARC-164 may also be loaned to the customer who can provide 120-VAC, 60- Hz power.

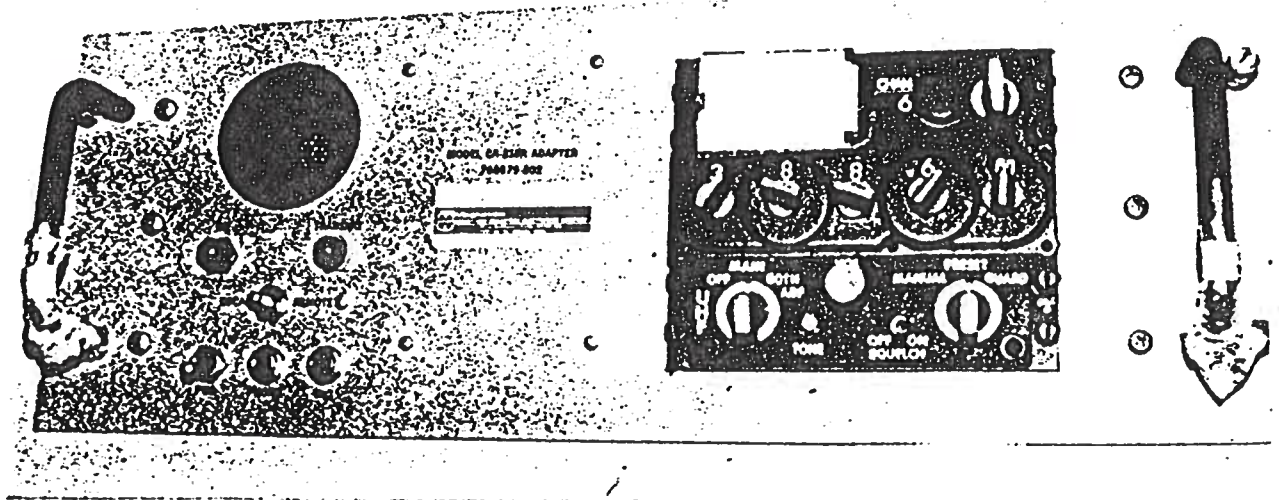


Figure 8, AN/ARC-164(V) UHF Radio System

SECTION III - DATA SYSTEMS

The data processing system consists of five AN/UGC-129(V)1 teletypewriters (figure 9) and four MU-688 magnetic tape memory units (not shown). Four of the UGC-129s and the four MU-688s are located on top of the cabinets in the rear of the van. These four sets are normally used for AUTODIN, Teletype, Orderwire, and Message Preparation. The fifth UGC-129 is located in the front of the van on the engine cover. It is normally used for printing messages received by the weather receiver. These assignments may be changed to meet operational requirements.

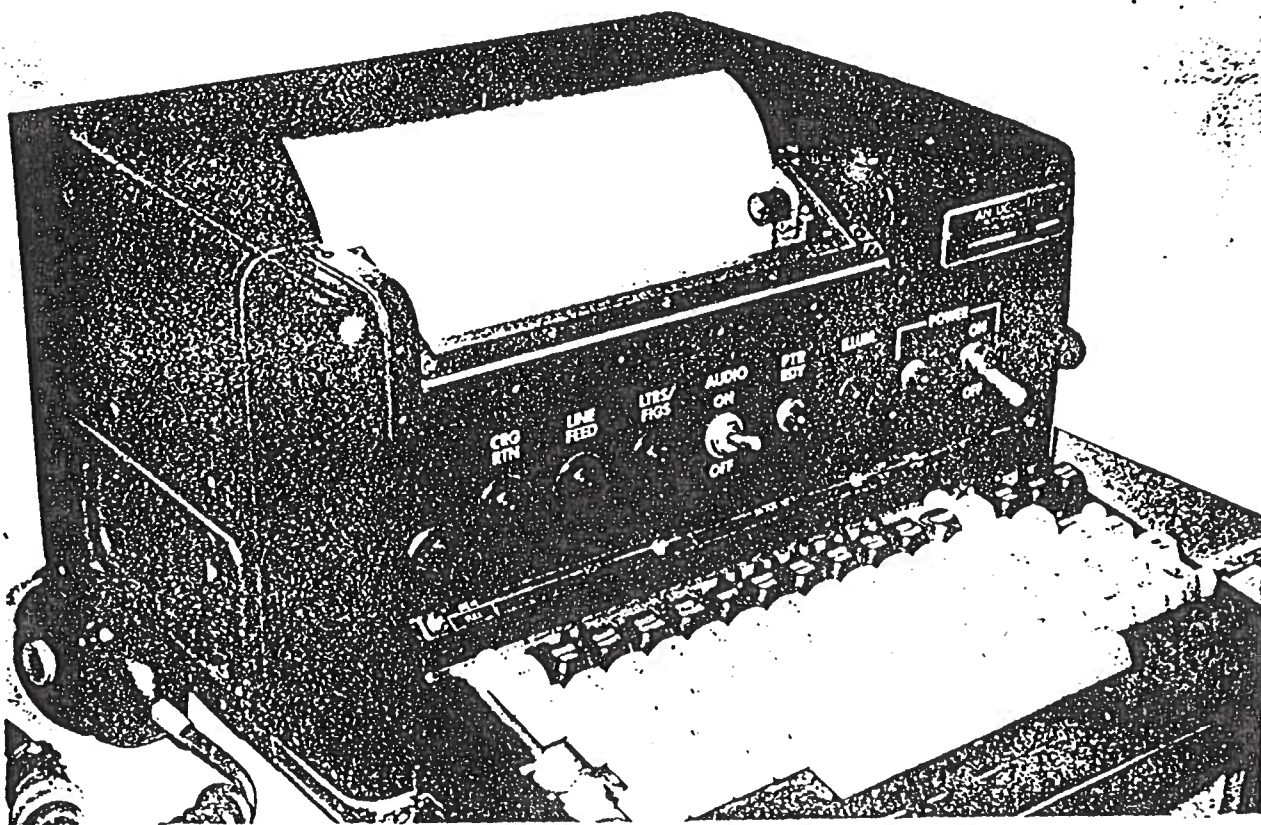


Figure 9, AN/UGC-129(V)1 Teletypewriter Set

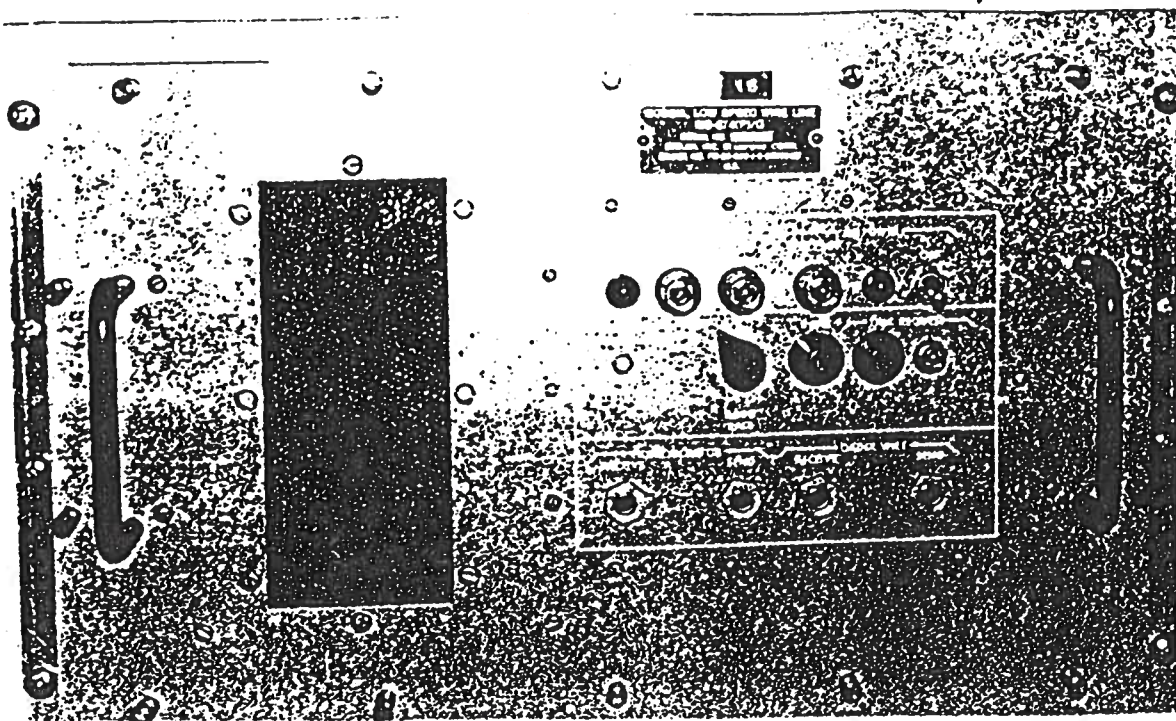


Figure 10, MD-674 Low Speed Modem

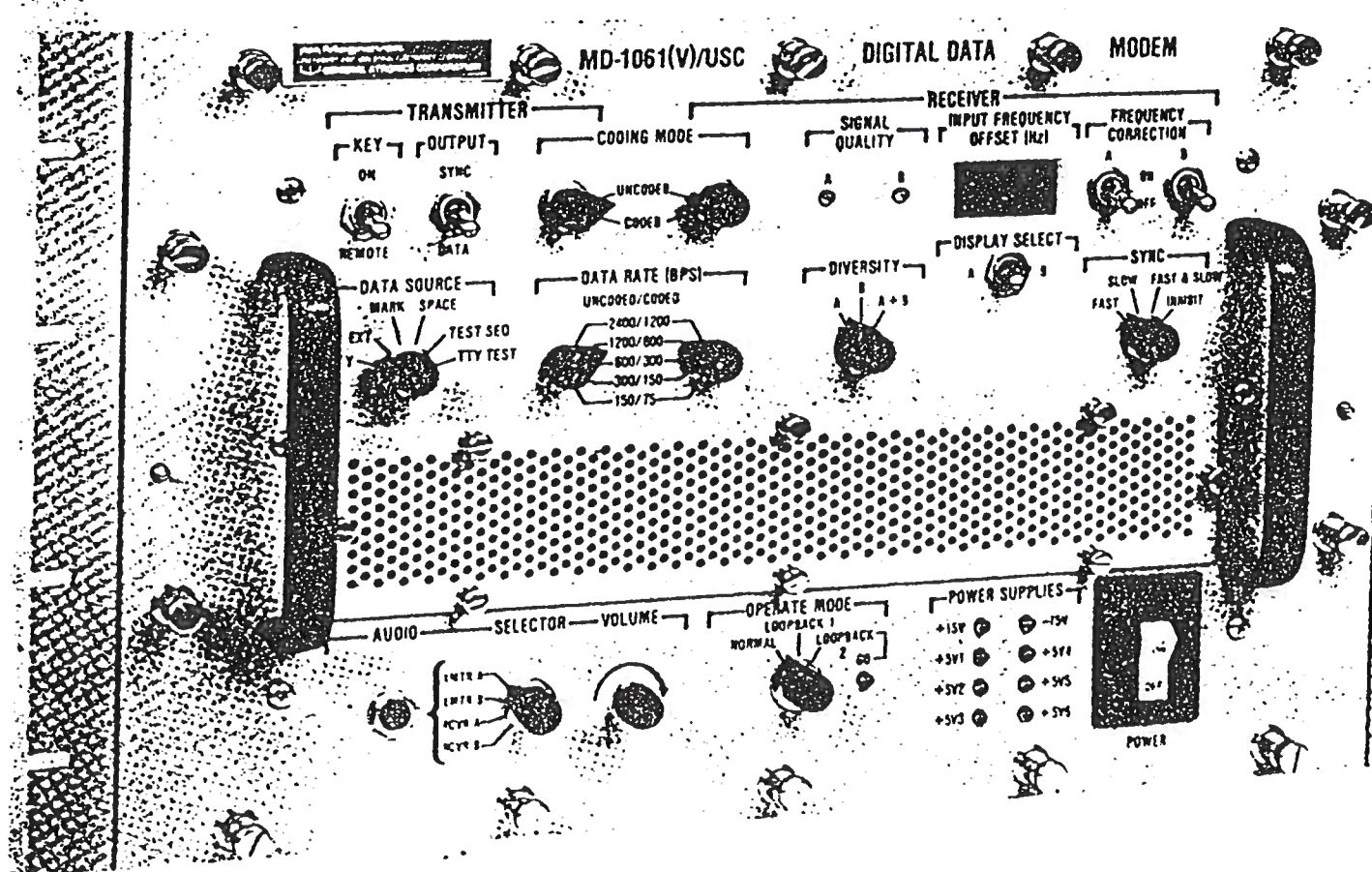


Figure 11, MD-1061 Digital Data Modem

The UGC-129 and MU-688 operate on 120 VAC, 60 Hz, and require MIL 188, 10-level DC interface (± 6 volts).

NOTE: Any other interface level may destroy micro circuits on the A3 card of the UGC-129.

These units may operate in an asynchronous BAUDOT or ASCII mode, with baud rates up to 2.4K, or in the synchronous mode.

MD-674. The MD-674 (shown in figure 10) provides AUTODIN interface when using a GMF Satellite Earth Terminal or wireline. This Modem is located in the A4 equipment rack behind the passenger. The MD-674, as used in the QRP van, contains modules for 1200-baud operation. These modules require MIL 188 10-level DC inputs from the equipment side, and 1200-Hz mark and 2400-Hz space frequencies on the line side.

MD-1061. The MD-1061 Digital Data Modem is available for converting high-speed teletype for transmission over HF media. This modem (shown in figure 11) is located in rack A5 between the driver and passenger. The MD-1061 accepts 10-level polar inputs at data rates up to 2400 baud (uncoded) or 1200 baud (coded). The audio input and output is a tone pack in the audio frequency range. The MD-1061 also has provisions for dual audio inputs and outputs for space diversity operation and frequency diversity over separate transmission media.

NOTE: The MD-1061 is wired through patch panel A6, for "A" diversity ONLY, on both transmit and receive.

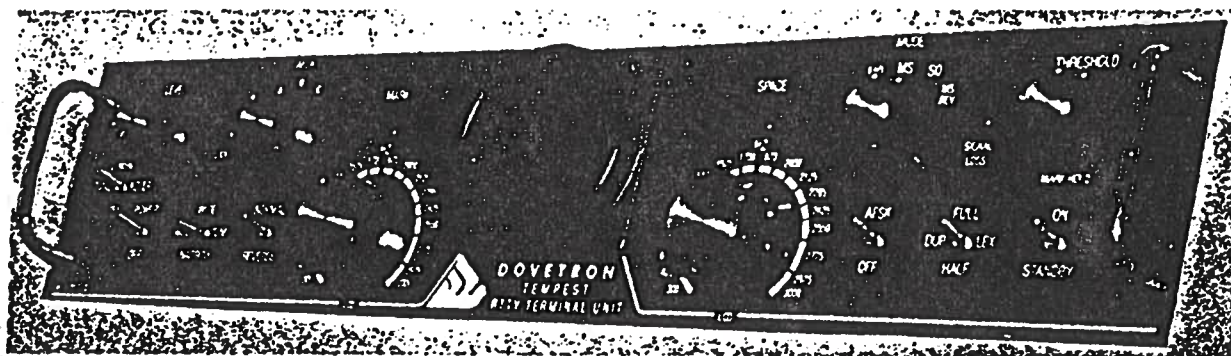


Figure 12, MPC-1000T RTTY Keyer/Converter

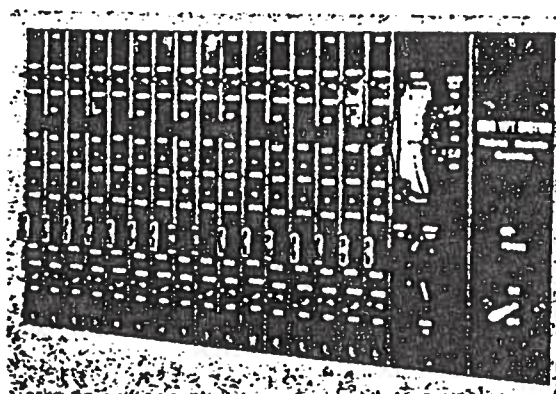


Figure 13, Frederick Model 1290 HF/VFT (FDM Modem)

MPC-1000T. The MPC-1000T Modems (figure 12) are used for converting low-speed (50, 75, or 110 baud) teletype signals to tones and vice versa. The equipment data inputs and outputs are again ± 6 VDC. The line audio input/output is set for 0 dBm at 600 ohms. The line audio frequency output is front panel selectable to one of three preset center frequencies: 600, 1275, or 2000 Hz. The line audio input frequency is continuously variable from 300 to 3000 Hz by front panel mark/space controls. The MPC-1000T may be operated in the half-duplex or full-duplex mode. There are three MPC-1000Ts in the QRP van. The first is located in equipment rack 1A4. The other two are in equipment rack 1A5.

1290 HF/VFT. The Fredericks 1290 HF/VFT (figure 13) is a frequency division multiplex (FDM) Modem for transmitting and receiving eight channels of frequency shift keying (FSK). All eight channels of FSK are arranged at separate frequencies within a 300- to 3000-Hz voice channel. Therefore, a narrow shift (± 42.5 Hz) is used for each FSK signal. The 1290 has two composite inputs and outputs, appropriately called Composite #1 and Composite #2. For use in the QRP, Composite #1 output is adjusted for -10 dBm at 600 ohms. This is because the Composite #1 signal is primarily used for satellite communications. The Composite #2 output is set for 0 dBm. Both Composite #1 and #2 inputs should be from +6 to -40 dBm (nominal 0 dBm). Data interface is again lo-level polar.

The allocated center frequencies of each of the eight individual channels are as follows:

CH 1 - 425 Hz
CH 2 - 595 Hz
CH 3 - 765 Hz
CH 4 - 935 Hz
CH 5 - 1105 Hz
CH 6 - 1275 Hz
CH 7 - 1445 Hz
CH 8 - 1615 Hz

The Fredericks 1290 HF VFT is located in equipment rack 1A5.

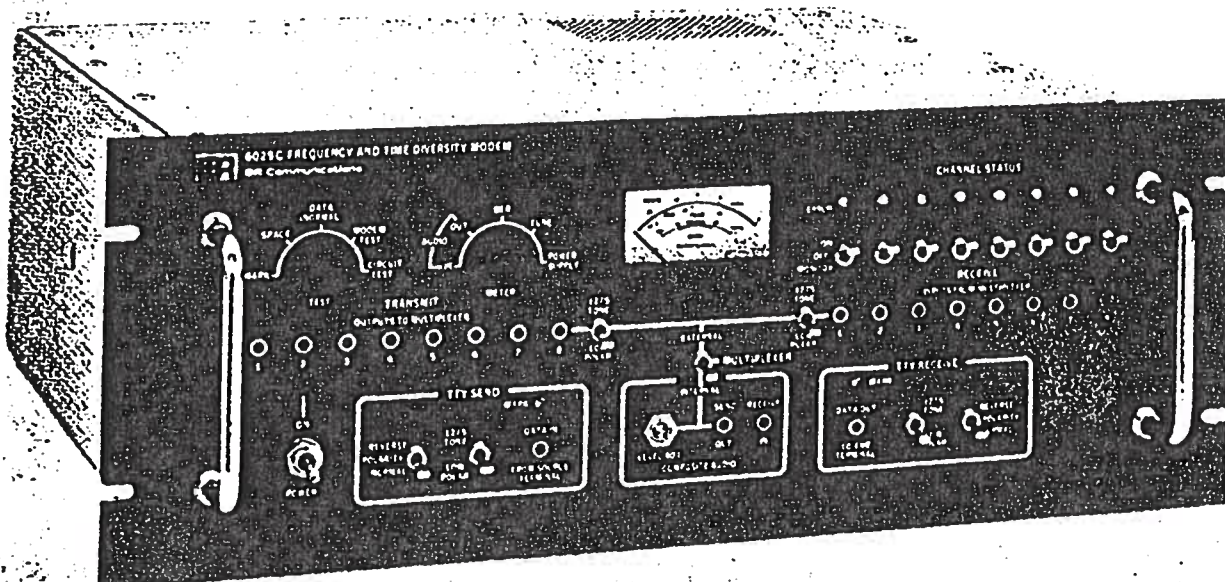


Figure 14, MD-1142/UGC Time Diversity Modem (BRC 6029C)

MD-1142/UGC. The remaining modem of the QRP is the MD-1142/UGC shown in figure 14. This unit, sometimes called a BRC 6029C, is a full-duplex, Time Diversity Modem. This modem offers immunity to signal dropouts and noise bursts of up to 3-seconds duration. To accomplish this feat, the MD-1142 accepts a data input (either lo-level polar or 1275-Hz tone signaling) and sends it to a delay network. Here, the original data signal is delayed seven times at 1-second intervals, giving you an output of eight data signals (the original and seven delayed signals) which vary from no delay to 7 seconds of delay.

At this point these signals are either sent to an external multiplexer (Fredericks 1290) or the internal multiplexer. Here, the signals are frequency-shift keyed to staggered center frequencies with an 85-Hz shift. All frequencies are within the 3-kHz voice spectrum.

At the distant end the opposite occurs. After demultiplexing (internally or externally), the data signals are again delayed. (This time the first arrival is delayed 7 seconds.) The eight signals are then compared in a voting network, and the majority of marks or spaces determines what the output data signal will be -- either lo-level polar or 1275 Hz tone.

The MD-1142 will accept lo-level polar inputs at any rate up to 110 baud. For tone data inputs from the signal source, the signal must be 1275 \pm 42.5 Hz, 0-dBm optimum input and output level. In the external multiplexer mode, the outputs to the multiplexer are again, either lo-level polar or 1275 \pm 42.5-Hz tone. In the internal multiplexer mode, the output from the internal multiplexer consists of tone signals with 85-Hz shift. The center frequencies are 850, 1190, 1530, 1870, 2210, 2550, and 2890 Hz. Again, these signals should be at the 0-dBm level.

NOTE: You probably noticed that there are only seven center frequencies. In the internal multiplexer mode, only seven information signals are used; the eighth signal is a 561-Hz pilot tone.

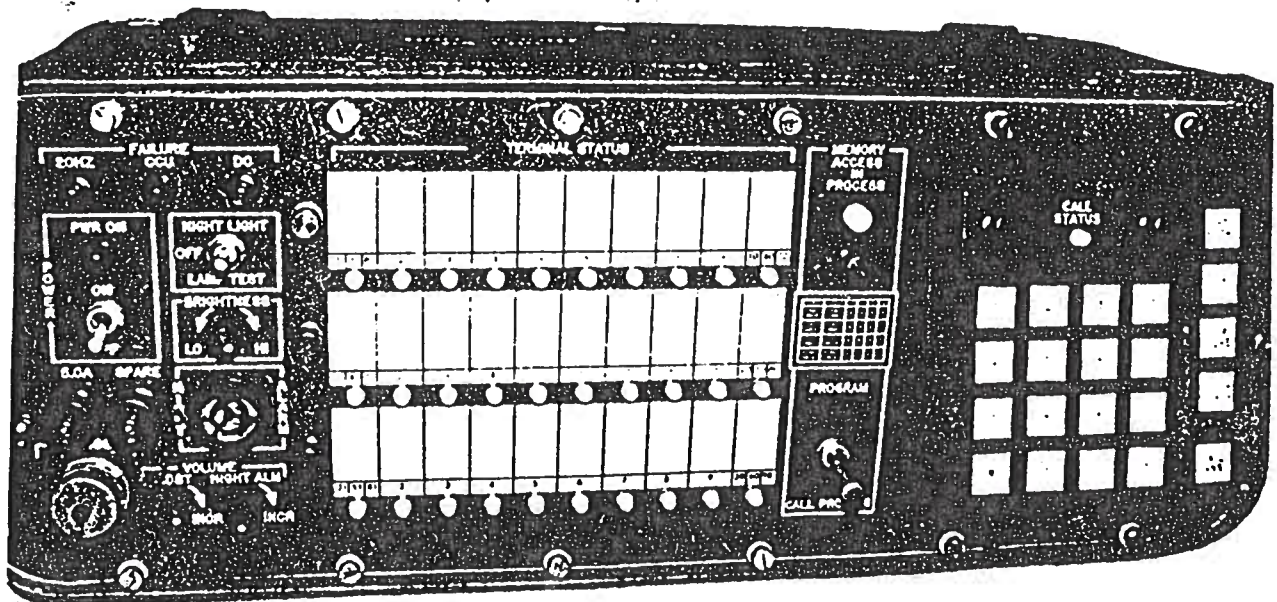


Figure 15, SB-3614/TT Programmable Switchboard

SECTION IV - VOICE SYSTEMS

SB-3614/TT. The heart of the voice system of the QRP is the SB-3614/TT switchboard. The SB-3614, is a 30-line, tactical, ruggedized switchboard, shown in figure 15. There are a variety of services offered by the SB-3614. The particular service offered is determined by the use and placement of five different types of terminal cards. Available services are as follows:

- a. 2-wire CBS and ringdown subsets and 2-wire trunks
- b. Common-battery dial pulse and common-battery DTMF subsets
- c. 4-wire trunk operation
- d. 6-wire E&M supervision dial pulse, and E&M supervision DTMF lines and trunks
- e. DC-closure dial pulse and DTMF trunks (to local Dial Central Office)

There are 15 terminal card locations within the SB-3614. Each terminal card supports 2 circuits, giving you a 30-circuit capability with only 15 cards. The only restriction for placement of these cards is that the first 6 cards (first 12 circuits) are reserved for 2-wire circuits.

In addition to placement of the terminal cards for determining circuit arrangements, the SB-3614 may require programming. To assign Trunk Group or Trunk Terminal numbers, Precedence Level, Operator Intercept, or Special Classmarks, the SB-3614's microprocessor is programmed using the 4X4 keysender and the program switch.

NOTE: Special Classmarks give specific operational modes of certain terminal cards that are not otherwise obtainable.

During transit, the SB-3614 is stored in the rear of the QRP van. During operation, it's placed on a shelf in front of the driver's seat. Quick connect signal cables and power cords are provided at this location.

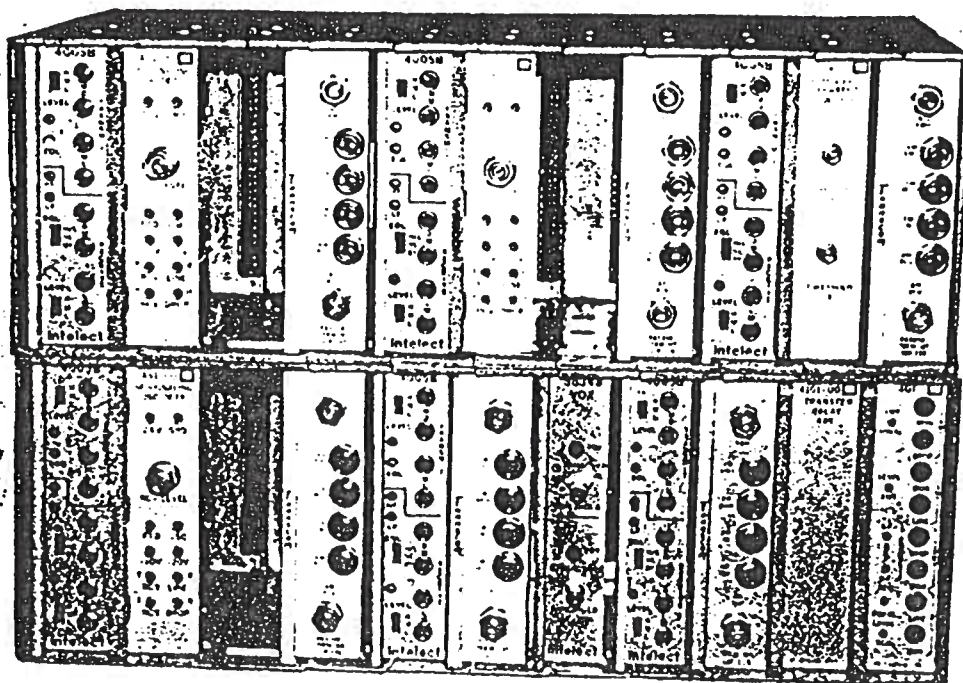


Figure 16, WESCOM AUTOVON Interface

WESCOM AUTOVON INTERFACE. There are three Autovon Interface packages included in the QRP. Each package consists of five individual printed circuit cards. The prime manufacturer of these cards is WESCOM; therefore, the package is commonly referred to as the "WESCOM Interface". See figure 16.

This package is used to interface the SB-3614's 6-wire autovon terminals with 4-wire radio circuits. The 4522 Signaling Module picks up the 2-wire voice circuit and the E and M leads from the SB-3614. This module supplies the 2600-Hz SF tone. The 443 Term Set converts 2-wire to 4-wire. The 451 Common Module applies the SF tone. The 401 Line Amplifier provides the proper output level to the line.

On the receive side: The 401 Line Amplifier again provides the proper level. The 451 Common Module provides more amplification. The 443 Term Set converts 4-wire to 2-wire. The 4522 Signaling Module detects the 2600 Hz and provides E-lead signaling to the SB-3614. There are three sets of these cards available for three separate autovon circuits. These cards are rack mounted on the rear side of rack 1A5.

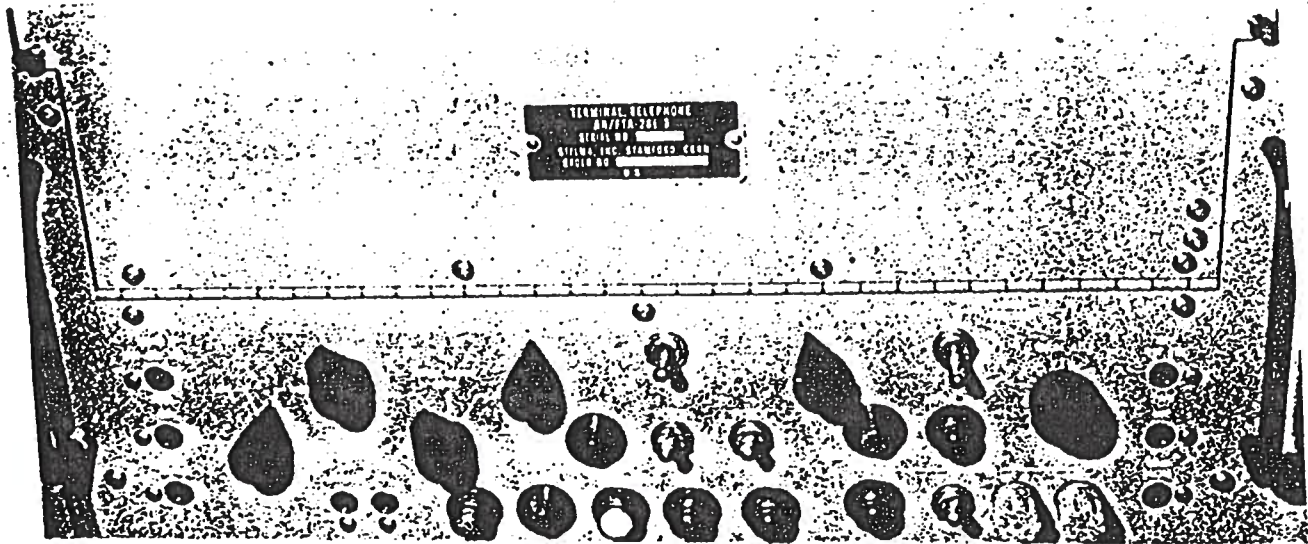


Figure 17, AN/FTA-28 Signal Converter & Termination Unit

FTA-28. The AN/FTA-28 (figure 17) is provided to accommodate telephone service over HF/ISB radios by interfacing the SB-3614 switchboard with the HF/ISB radio system. When a subscriber dials the number assigned to the FTA-28, the SB-3614 sends a 20-Hz, 90-volt signal to it. The FTA-28 converts this 20-Hz signal to an in-band signaling tone which is applied to the HF/ISB transmitter. The FTA-28 also converts the 2-wire voice circuit to 4-wire.

NOTE: Several tones are available: 1600 or 1000 Hz, pulsed at a 20-Hz rate, or a center frequency of 2300 Hz, varied at a 69-Hz rate. At this time the QRP engineers haven't determined which tone will be used. The FTA-28 may require re-strapping to meet operational requirements for each deployment.

When in the TONE CONTROL mode the FTA-28 will send a steady tone to the distant end (during idle conditions). This tone is detected on the distant end and illuminates a RADIO IN lamp to insure the operator that the radio circuit is operating.

On the receive side, the 4-wire voice circuit is changed back to 2-wire. The in-band signaling tone is detected by the FTA-28, and a 20-Hz, 90-volt ring is applied to the switchboard. The FTA-28 is located in the 1A5 equipment rack.

STU-5A. Four STU-5As are provided to meet a variety of telephone interface needs (figure 18). They may be used with the SB-3614 or with individual telephone circuits. The STU-5A may interface with 2-wire, 4-wire, or 6-wire switchboard/telephone systems. The line side is 4-wire. Signaling options are 570, 1600, or 2600 Hz, with E and M signaling also available. The STU-5As are located in the top of the 1A4 rack.

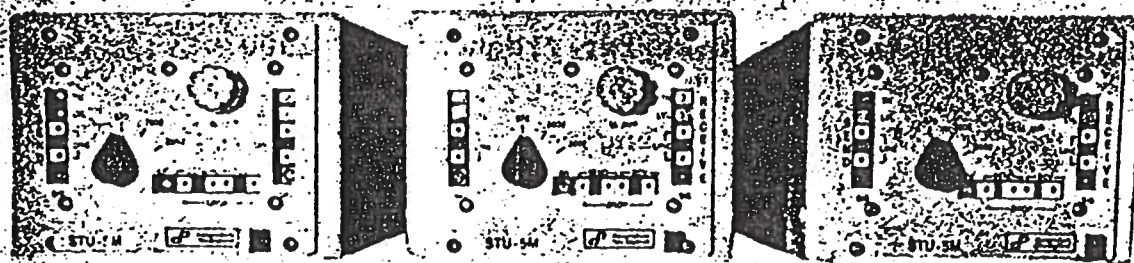


Figure 18, STU-5A Signal Termination Unit

TA-938/G. Twenty-five TA-938/G telephones (not shown) are included for use with the QRP. The TA-938 is a 2-wire, DTMF telephone set. During deployment, the TA-938s are normally assigned to subscribers. During shipment, they are stored in the rear of the QRP van.

SECTION V - SECURE SYSTEMS

Secure data circuits for the QRP van are provided by the following equipment (not shown):

<u>Qty</u>	<u>Nomenclature</u>	<u>Purpose</u>
4	TSEC/KW-7	Low-speed, secure data
3	KWX-8	Remote control for TSEC/KW-7
1	KWS-11 (modified)	TSEC/KW-7 interface
	TSEC/KG-13	High-speed, secure data
	KWS-11	High-speed, secure data
2	MASTECH ± 6 V Power Supplies	Provide lo-level voltage for KWX-11
4	TSEC/KG-84	High-speed, Secure Data

Secure voice services are provided by the following equipment:

<u>Qty</u>	<u>Nomenclature</u>	<u>Purpose</u>
2	TSEC/KY-65	Parkhill narrowband voice encryption/ HF Radio
2	HYX-60	Parkhill wireline adaptors
2	TSEC/KY-57	VINSON wideband voice encryption/ VHF-UHF Radio
4	HYX-57	VINSON wireline adaptors

All secure systems are located in the rear of the QRP van.

SECTION VI - TEST EQUIPMENT

The QRP includes the following Built-In Test Equipment (BITE):

- a. Hekimian 3901M Test Set (figure 19)
- b. Tektronix DM501A Digital Multimeter (figure 20)
- c. Tektronix SG502 Oscillator (figure 20)
- d. Tektronix DC508A Frequency Counter (figure 20)
- e. Tektronix SG503 Signal Generator (figure 20)
- f. Tektronix SG504 Oscilloscope (figure 20)
- g. Tektronix RTM506 Rack Mount (for items b-f) (figure 20)
- h. GGM21A Teletype-Data Test Set (figure 21)
- i. HLI 41-01 Transmission Test Set (figure 22)
- j. DC Voltmeter and VU Meter Panel (figure 23)

The Hekimian and Tektronix equipment are located in equipment rack 1A6. The GGM-21A, 41-01, and meter panel are located in rack 1A5.

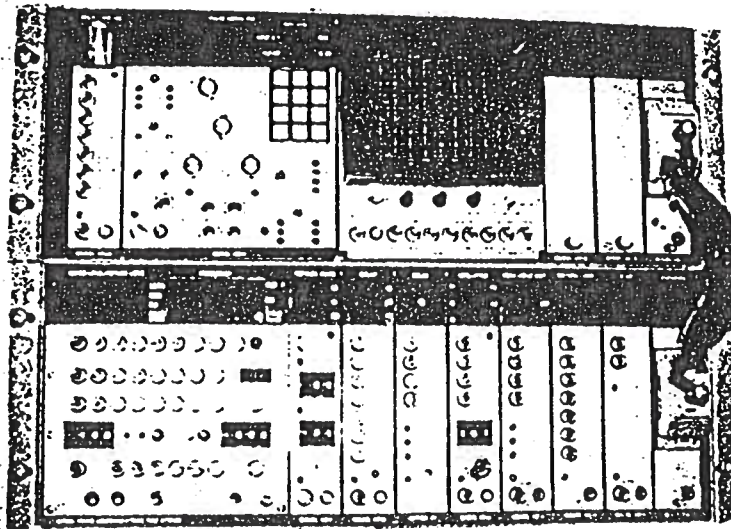


Figure 19, Hekimian 3901M Test Set

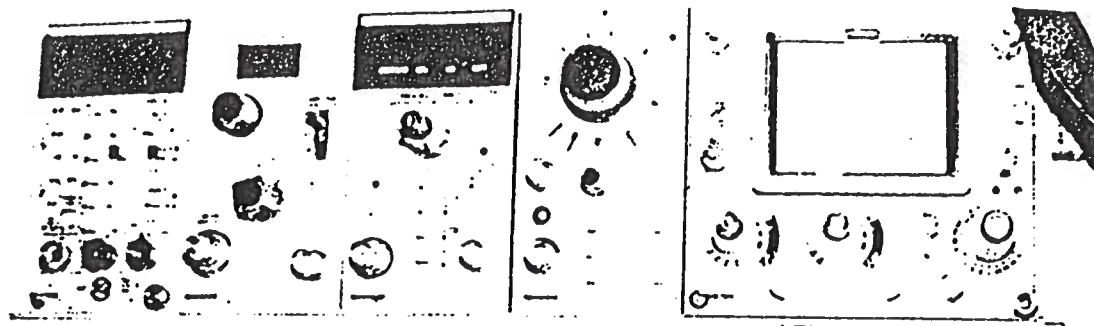


Figure 20, Tektronix Test Set

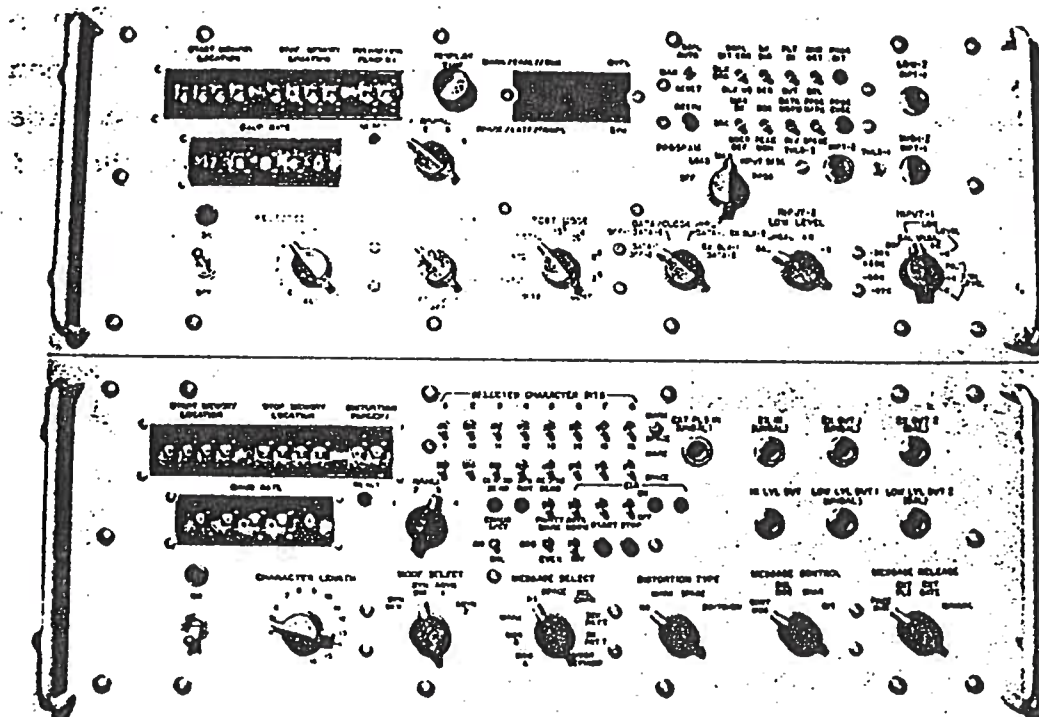


Figure 21, GGM-21A Teletype-Data Test Set



Figure 22, HLI 41-01
Transmission Test Set



Figure 23, DC Voltmeter
and VU Meter Panel

Each van is also authorized a PSM-2A Megger and a Simpson 260 Multimeter. Each AN/TSC-107 O&M maintenance activity is authorized a Tektronix 492 Spectrum Analyzer and RTM506 Rack Mount for in-shop use of the Tektronix equipment normally mounted in the QRP van.

ADDITIONAL INFORMATION

This has been a brief introduction to the AN/TSC-107 Quick Reaction Package (QRP). For a detailed description of individual equipment items, consult the appropriate QTP or Technical Manual. The following QTPs are under development and when complete, may be requested through your Publications Distribution Office (PDO). Watch for announcements in the MAC/AFCC Publishing Bulletin. After the QTPs are published, they will be listed in AFCCR 0-7.

<u>Publication</u>	<u>Title/Contents</u>
CTP 304X4-31G	System Training Package (Maintenance of the QRP from a "patch panel" point of view; covers test equipment & some communication equipment in detail)
CJQS 304X4-31H	URC-92 HF/SSB Radio System
CJQS 304X4-31I	Sunair HF/ISB Radio System
CJQS 304X4-31J	UGC-129 Teletype (includes MU-688 Memory Unit)
CJQS 304X4-31K	MD-1142 Time Diversity Modem (6029C)
CJQS 304X4-31L	MD-1061 Digital Data Modem
CJQS 304X4-31M	MD-674 Low speed AUTODIN Modem
CJQS 304X4-31N	MC-1000T RTTY Keyer/Converter
CJQS 304X4-31O	Frederick Model 1290 VFCT (FDM Modem)
CJQS 304X4-31P	SB-3614/TT Programmable Switchboard
CJQS 304X4-31Q	FTA-28 Signal Converter & Termination Unit
CJQS 304X4-31R	STU-5 Signal Termination Unit
CJQS 304X4-31S	WESCOM AUTOVON & Radiotelephone Interface

(QTPs -31H through -31S will cover detailed maintenance procedures on specific equipment.)